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SUBERIZATION OF POTATO SETS IN ITS RELATION TO STAND AND YIELD

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The suberization and corking over of wound surfaces of the potato has become a matter or economic importance both from the standpoint of protection against the organisms which cause seed piece decay and from that of farm management. As a rule, more efficient use can be made of farm labor if potato seed can be cut before field work begins. The experiments reported in this paper have been conducted for six years in an effort to determine how long before planting seed can be cut without loss of stand or yield.

Investigators have very largely confined their studies to the actual phenomena of suberin deposit over wound surfaces and periderm formation beneath the suberin layer and apparently have made no effort to determine the economic value of suberized potato sets. In many studies of the relation of light, temperature and humidity to the development of a new periderm, they have found that temperature and humidity were the important factors and that light played no role of importance.

Kny (*9*) found that wound periderm formation is favored to the same extent in diffuse light or in the dark in tubers free from chlorophyll, provided moderate atmospheric moisture is prevalent.

Olufsen (*10*) found that immature tubers react to wound stimulation faster than mature tubers and that dead and thickened tissues do not react to such stimulation. He discovered further that periderm formation accompanies any kind of wounding, and that the wound cork is a better protection against the attacks of microörganisms than the normal peel.

Appel (*1*) was the first to investigate the problem from the viewpoint of the plant pathologist. In his experiments with potatoes kept in a moist chamber at 20° C., the suberization of the cut surface had made such progress twelve hours after cutting that a virulent culture of *Bacillus phytophthorus* was unable to penetrate the tissue, even though the new periderm was not yet formed.

Shapovalov and Edson (*12*) concluded that sprouting alone does not affect the ability of the potato tubers to form new cork over the wound surfaces, but drying of the tissues which usually accompanies sprouting when potatoes are stored in a warm room for a long period, checks this ability. They believe that susceptibility of badly shrunken tubers to attack by decay-producing organisms in the soil is of outstanding practical significance.

In studies with black leg, Bonde (*2*) found that rapid decay of seed pieces in the soil was dependent upon shallow lesions caused by various fungi and bacteria on unhealed surfaces, and upon the entrance of seed corn maggots through such lesions. Therefore with maggots present, decay from infection by fungi or bacteria occurred in freshly cut seed pieces planted in non-sterilized soil, but not in suberized seed pieces planted in non-sterilized soil or in freshly cut seed pieces planted and becoming healed in sterilized soil. Under commercial potato growing conditions in Maine the maggots show a similar relation to seed-piece decay, except that entrance lesions caused by fungi and bacteria develop largely in storage and not in soil, even on freshly cut seed.

Where Goff (*7*) and Reed (*11*) found yield increases from cutting seed in advance of planting, Foster (*5*) and Harrington (*8*) got better yields from freshly cut seed. The more recent work of Clayton (*3*) suggests that comparable yields are often obtained from seed cut quite a period in advance of planting, compared with freshly cut seed, if the former is properly healed over before being placed in storage.

Gardner (*6*), after interviewing sixty growers in Jefferson Co., Kentucky, regarding local practices, concluded that seed which was to be cut quite a period in advance of planting must be well matured, handled carefully at harvest time and held until time of cutting in ventilated receptacles at a temperature of 35° to 37° F. Early cutting of seed in Kentucky, it was explained, permits the use of farm labor when other out-door activities are at a standstill.

Wright and Peacock (*16*) showed that the best results were secured if the temperature at time of cutting was 60° F. with a high

humidity, if such conditions were maintained for several days before going into storage.

Westover (*15*) cut seed in storage at approximately two-week intervals, from October 17, 1921, to April 24, 1922; the temperature ranged from 38° to 42° F. The loss in weight was quite rapid for the first one hundred days. Marked withering and discoloration occurred only in the oldest lots. Those stored for the longer periods gave great reduction in yield.

Stallings (*14*) in Florida, compared freshly cut seed with that cut 24, 48, 72 and 96 hours before planting; the lot cut 72 hours gave the best stand. In comparing sets dusted with sulphur, lime, manganese sulphate, manganese and copper sulphates, those dusted with lime were the most uniform in germination and growth; those treated with manganese sulphate and copper sulphate failed to germinate.

Materials and Methods

Experimental studies with the variety Irish Cobbler to determine the relative value of old vs. freshly-cut sets was begun by the Division of Fruit and Vegetable Crops and Diseases at Aroostook Farm, Presque Isle, Maine, in 1924. The data presented include the results obtained from 1924 to 1929, inclusive.

The first four years seed pieces were cut in Maine approximately every ten days beginning soon after April 1. No attempt was made during this period to suberize them under controlled conditions. The tubers were taken from storage to the adjoining work room, cut into bushel crates and then returned to the storage room. In 1928 the first four lots were cut at Arlington Farm, Virginia, on the following dates: February 10, 24 and March 23. On the day cut, each lot was placed immediately in the control room and held for six days at a temperature of 60° F. and a relative humidity of 85 per cent. In 1929 the first lots cut December 11, January 11, February 11 and February 25 were treated in the same manner. Seed pieces cut at the Arlington Farm were taken from the control room after the sixth day and held in storage at 40° F. until the middle of April, when all lots were shipped to Presque Isle, Maine, where they were stored until planted. The temperature in the storage room on Aroostook Farm varied from approximately 40° in April to approximately 50° when the seed was planted late in May. Each year check lots were cut in the morning and planted with the earlier cut seed pieces in the afternoon.

Shrinkage data for seed pieces stored in 1926 and 1927 are presented in table 1.

TABLE 1.—*Shrinkage of cut seed in storage, 1926 and 1927.*

Age of Cut Seed, Days	Original Weights		Shrinkage		
	1926 (Ozs.)	1927 (Ozs.)	1926 (Per Cent)	1927 (Per Cent)	Mean (Per Cent)
0	1008	1008	0.0	0.0	0.0
10	1008	1008	0.0	0.73	0.36
20	1008	1136	0.79	1.10	0.94
30	1008	1160	1.19	2.11	1.65
40	1008	1152	1.98	2.76	2.37
50	1008	1200	2.38	4.00	3.27

Shrinkage varied with the season, a fact illustrated in comparing the per cent of shrinkage in 1926 with that of 1927. With no temperature control in the potato house, the inside temperature was more or less dependent on the outside temperature, particularly during the month of May.

Stand records throughout the six-year period (table 2) show some variation for the different years, a small gradual decrease being apparent in seed cut for 30, 40 and 50 days.

TABLE 2.—*Mean per cent stand from freshly-cut and suberized seed at Presque Isle, Maine, 1924 to 1929, inclusive*

Age of Cut Seed, Days	1924	1925	1926	1927	1928	1929	6-Year Average
0	99.8	99.0	99.2	98.3	100.0	100.0	99.1
10	99.6	99.4	99.9	100.0	100.0	100.0	99.3
20	99.4	99.2	99.9	99.5	99.0	100.0	99.5
30	99.0	97.8	99.5	97.7	99.5	100.0	98.9
40	98.4	94.0	99.0	95.5	99.5	99.5	97.8
50	99.8	96.9	99.7	85.6	99.0	98.0	96.3[1]

[1]Twice the standard error of a difference between 6-year averages is .77.

The planting plan was the same during the six-year period. The sod land was plowed deep in the fall and fitted in the spring with a disk harrow followed by a spring tooth. Four 1/100-acre rows of each

plot were systematically replicated. The rows were thirty-six inches apart with sets fourteen inches in the row.

The mean annual yield of four plots of each treatment and the average for six years are given in table 3.

TABLE 3.—*Yield of freshly-cut vs. suberized Irish Cobbler seed Maine, 1924 to 1929, inclusive*

Age of Seed Cut, Days	Yield in Bushels Per Acre of Primes						
	1924	1925	1926	1927	1928	1929	6-Year Average
0	275.0	360.0	345.2	307.1	379.8	296.1	327.2
10	322.9	380.0	345.2	303.8	365.1	281.1	333.0
20	274.6	363.7	361.9	289.4	358.3	270.7	319.2
30	301.2	360.0	347.7	291.9	387.9	266.5	325.9
40	209.2	331.6	355.6	295.0	371.0	259.3	306.8
50	275.0	346.7	330.2	275.6	356.3	287.8	311.9

The analysis of the data* was made according to the method outlined by Fisher (*4*) for dividing the variance into its component parts. The probabilities of significance were determined by the use of Snedecor's (*13*) tables for value of F. (table 4).

In the analysis of variance the standard error of a single acre is 23.28 bushels; for a mean of four acres, 11.64 bushels and for the mean of six years, 4.75 bushels. Twice the standard error of a difference between six-year means is 13.43 bushels. Taking this as the criterion of significance, there are no significant differences between the first four treatments, namely, freshly cut sets and those cut 10, 20 and 30 days before planting. The differences in the yields of the sets cut 40 and 50 days compared with freshly cut sets are, however, significant.

The mean square due to treatments is highly significant in that the value of F exceeds the 1 per cent point. This indicates that the chances are less than 1 in 100 that the differences in treatment yields were because of random error. The significant F value for treatments also shows that the average yields of these treatments over the six-year period 1924-1929 are significantly different.

*The assistance of Dr. F. J. Stevenson, of the U. S. D. A. potato project, in making and interpreting the statistical analyses is gratefully acknowledged.

TABLE 4.—*Analysis of variance*[1] *for testing Irish Cobbler freshly-cut vs. suberized sets in Maine from* 1924 *to* 1929, *inclusive*

Sources	D/F	Sum of Squares	Mean Sum	F
Treatments	5	4023.65	804.73	4.1[2]
Years	5	76183.30	15236.60	78.0[2]
Replicates	3	1905.40	635.10	3.25[3]
Treatment X years	25	8670.10	346.80	1.77
Treatment X replicates	15	4169.50	277.96	1.42
Years X replicates	15	12937.00	862.46	4.42[2]
Error	75	14645.84	195.27	
Total	143	122534.79		

[1]Calculations made on pounds in each plot. The factor for changing pounds in each plot to bushels to the acre is 1.6666.
[2]Exceeds the 1 per cent value for F.
[3]Exceeds the 5 per cent value for F.

COOPERATIVE TESTS

To supplement the studies conducted at Presque Isle, Maine, and Arlington Farm, Virginia, comparing freshly cut with suberized potato sets for planting, it was thought advisable to conduct the study in different localities to observe the relation of different soil and climatic conditions. Consequently a cooperative project was undertaken early in 1933 by Dr. William Stuart, recently retired project leader of Potato Investigations of the U. S. D. A., with M. E. Gardner of the North Carolina Agricultural Experiment Station; H. H. Zimmerley, Virginia Truck Experiment Station; W. H. Martin, New Jersey Agricultural Experiment Station; E. V. Hardenburg and P. H. Wessels, New York Agricultural Experiment Station at Cornell University; H. C. Moore, Michigan Agricultural Experiment Station and F. A. Krantz, Minnesota Agricultural Experiment Station. The tests were continued, too, at Presque Isle, Maine, and at Arlington Farm, Virginia; in all, 8 localities, providing both northern and southern conditions.

The same source of certified Irish Cobblers was used for all cooperators. This was divided into eight lots, each cooperator receiving half of his allotment about two weeks prior to his intended planting date. The other half was held at Arlington Farm, Virginia, where part of it was suberized and the balance held for a check. Half of the first shipment to each cooperator was suberized locally and half reserved for a check lot. Suberization of seed at Arlington Farm and at each station took place on the same dates. The cut seed was

held for about ten days at an approximate temperature of 60° F. and with a relative humidity of about 85 per cent. Each cooperator received the Arlington Farm suberized seed and a check lot a few days prior to his planting date. Both Arlington Farms, Virginia, and locally held checks were cut on the date planted. The test plots were planted as quickly as possible after the seed stock was received. In most cases each lot was planted in six rows of one hundred sets each. The rows were systematically replicated. The yields given in table 5 are the mean of six plots.

TABLE 5.—*Yield of freshly-cut seed pieces as compared with suberized seed pieces at eight stations in* 1933

Locality (where grown)	Mean Yield of 6 Plots in Bushels Per Acre				Standard Error of Difference	F
	A[1]	B	C	D		
Aroostook Farm, Presque Isle, Me.[2]	197.9	200.6	203.4	196.5	16.19	
Mich. Potato Station, Lake City, Mich.[2]	94.7	111.6	106.5	108.4	8.08	6.21[4]
Univ. Farm, St. Paul, Minn.[3]	145.8	158.4	149.2	155.9	12.4	1.83[5]
Cranbury, New Jersey[3]	265.1	255.2	260.4	252.8	12.21	
L. I. Research Farm, Riverhead, N. Y.[2]	208.9	211.1	216.8	202.0	16.01	
Va. Truck Exp. Sta., Norfolk, Va.[2]	70.2	74.5	70.0	69.0	8.90	
Arlington Farm, Va.	206.1	191.2	203.6	205.4	29.8	
Calypso, North Carolina[3]	126.6	110.0	127.5	123.6		
Average for all stations	164.4	164.1	167.8	164.2		

[1]A = freshly-cut sets held at Arlington Farm.
B = sets suberized at Arlington Farm.
C = freshly-cut sets held locally.
D = sets suberized locally.
[2]Yield of primes.
[3]Total yields.
[4]Exceeds the 1 per cent value for F.
[5]Less than the 5 per cent value for F.

CONCLUSIONS AND DISCUSSION

In the analysis of variance of the Presque Isle data the values for F indicated a high significance for treatments. This resulted from the low yield three years out of six for seed cut 40 days and the low yield five years out of six for seed cut 50 days or an average of low yield for both for six years. With twice the standard error of a difference or 13.43 bushels to the acre for the mean of six years, no significant difference was found in the yield of the freshly-cut seed and seed cut 10, 20 and 30 days, but the yield from the freshly-cut seed

pieces was significantly higher than that from the seed suberized 40 and 50 days, respectively. These data would then indicate that it is not advisable to use seed which has been cut more than 30 days under conditions as they exist on the ordinary potato farm.

With one exception the results secured at the eight stations in 1933, in comparing Arlington Farm suberized and freshly-cut, and locally suberized and freshly-cut seed, gave results corresponding to those secured over a six-year period in Presque Isle, Maine. At the Michigan station the Arlington Farm check gave a significantly low yield compared with the other three treatments. If twice the standard error of a difference is taken as the criterion of significance, there are no significant differences among the four treatments, at any station other than at Michigan, indicating that seed potatoes can be cut from 10 to 30 days in advance of planting without significantly decreasing the yield, providing cut seed is properly suberized and cared for during the storage period between cutting and planting.

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CONTROL OF THE POTATO FLEA BEETLE, *Epitrix cucumeris* Harris ON THE EASTERN SHORE OF VIRGINIA

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The potato industry on the Eastern Shore of Virginia has been seriously affected by the potato flea beetle, *Epitrix cucumeris* Harris, for the past six years. This pest has reduced the yield approximately 25 per cent in the northern part of Accomac county and has caused a reduction in quality of potatoes grown. In view of these facts control studies have been in progress the past five seasons on several farms near New Church, Virginia.

From a survey of the literature on potato flea-beetle control, it was found that different materials were recommended in different areas. Because of the variations in control recommendations, experiments were started in 1932 to determine the best method of controlling the potato flea-beetle in Eastern Virginia. In order to test a large number of insecticides, the size of the plats was restricted for the first few seasons to three rows, ranging from 45 to 50 feet long, replicated three times on each of the two farms. The insecticides were applied with hand equipment. In these small plat tests: thirty-seven different insecticide combinations were tested in 1932 (1); twenty-nine in 1933 (2); and nineteen in 1934.

From the 1932 and 1933 experiments it was found that such materials as calcium, lead, magnesium, and zinc arsenates gave partial control of the potato flea beetle when used alone, but were more effective when used in combination with other materials, especially Bordeaux sprays or dusts. Also, dusts and sprays containing mixtures of zinc sulphate, hydrated lime, and calcium arsenate gave nearly as good yields as did Bordeaux with calcium arsenate, but did not give so good foliage protection. However, the zinc sulphate spray mixtures settled very rapidly and caused frequent clogging of the sprayer nozzles; also some foliage injury occurred when they were not properly mixed.

Sodium aluminum fluoride (a synthetic cryolite), barium fluosilicate (Dutox), and Paris green, alone or in combination with other materials, as sprays or dusts, injured the foliage to such an extent that they were eliminated from further trials. This foliage injury was more pronounced during humid or rainy weather.

Such mixtures as Red A soap with Black Leaf 40, Penetrol

with Black Leaf 40 and pyrethrum soap (M-P), sprays, and a three per cent nicotine-hydrated lime dust seemed to have little effect on the beetles or the plants.

Derris products as sprays and dusts killed a high percentage of the beetles present at the time of application, but gave only temporary protection as other beetles soon reinfested the treated plats.

In 1934 weather conditions were very unfavorable for potato production. Heavy rains caused extreme water injury in part of the plats, making the yields very uneven. However, the untreated plats produced significantly lower yields than did practically all of the treated plats. Also, most of the higher yields and the least amount of flea beetle foliage injury occurred in plats treated with Bordeaux-arsenical combinations.

The materials which gave the most promising results in the small plat tests with hand equipment were tested on larger plats in 1934, 1935, and 1936 with gasoline engine and traction power equipment.

In 1934 tests were conducted, in which untreated duplicate four-row check plats were compared with plats treated with a calcium arsenate-Bordeaux (2-4-6-50) sprays, a calcium arsenate-monohydrated copper sulphate-hydrated lime (25-20-55) dust and a lead arsenate-hydrated lime (1-1) dust. The spray was applied at the rate of approximately 90 to 100 gallons to the acre to duplicate eight-row plats, and the dusts were applied at the rate of from 30 to 35 pounds to the acre to duplicate six-row plats. The rows were 30 inches apart and 525 feet long. Each treatment was applied on the 30th of May, and the eighth, sixteenth and twenty-ninth of June.

Potato flea-beetles were so abundant that they completely riddled the leaves on unsprayed plants, causing the leaves to wither and drop, which resulted in the death of these plants at least two weeks in advance of the sprayed plants. Potato leafhoppers and tarnished plant bugs were moderately abundant during this season.

Although the calcium arsenate-Bordeaux sprayed plats suffered a larger amount of water injury than did the other plats, they yielded 190 bushels of U.S. No. 1 potatoes an acre as compared with 162 bushels from the plats dusted with the calcium arsenate-copper-lime mixture; 150 bushels from those dusted with the lead arsenate-hydrated lime mixture; and 120 bushels from the untreated plats.

In 1935, insecticide control experiments were conducted on five farms. All treated and untreated plats were triplicated on each farm with the exception of one farm where 20 rows, 200 feet long, were left untreated as a check in a two-acre field sprayed with calcium arsenate-

Bordeaux. All sprayed and untreated plats were four rows wide, and the dusted plats three rows wide, with the exception of one test where eight and six-row plats were used. The rows varied from 200 to 450 feet, depending on the length of the rows in the field in which the experiments were conducted. Potato flea-beetles, potato leafhoppers, and tarnished plant bugs were present in approximately the same numbers and proportions as in 1934.

Foliage injury records were taken by counting the number of places or holes where potato flea beetles had fed on the leaflets. Samples of five leaflets were taken from each of three plants, 25 feet apart, from one of the inner rows of each plat. Instead of counting all the holes in each leaflet, counts were made from discs .568 sq. in. in area cut from the center of each leaflet with a circular cutter. In 1934 counts from 1350 of these .568 sq. in. samples gave within one per cent of the same results as counts made of all of the holes in the same leaflets. This method of measuring potato flea beetle leaf injury was used for all later tests.

The materials used and the results obtained from the experiment conducted on one farm in 1935 are given in table 1. The calcium arsenate-Bordeaux spray was prepared on the farm as it was used. Calcium arsenate-copper-lime dust was purchased ready for use. The Copper-Hydro "40", a commercial neutral copper sulphate, was mixed with calcium arsenate as it was used.

TABLE 1.—*Results of spraying and dusting potatoes for the control of potato flea beetles on one farm in* 1935

Materials Used	Flea Beetle Leaf Injury		Yield	
	No. of Holes to the Unit Area*	Per Cent Decrease	Bu. U. S. No. 1's to the Acre**	Per Cent Increase
Calcium arsenate Bordeaux spray (2-4-6-50)	6	89	188	46
Calcium arsenate copper lime dust (25-20-55)	24	56	174	35
Calcium arsenate Copper-Hydro "40" spray (2-4-50)	16	71	155	20
Untreated check	55	—	129	—

*These figures are an average of the number of holes in 0.568 sq. in. of leaf surface from each of 45 leaflets.
**A difference of 6.3 bushels may be considered significant.

An examination of table 1 shows that significant differences in yield occurred among all of the treatments and that the plats treated with calcium arsenate-Bordeaux spray gave the highest yields followed by those treated with the copper lime dust and Copper-Hydro "40" spray whereas the untreated plats gave the lowest yields. Also, the home-mixed calcium arsenate-Bordeaux sprayed plats had a comparatively small amount of foliage injury caused by the feeding of the flea beetles, although the other treated plats were moderately injured and the untreated check plats were severely injured.

The advantages of spraying potatoes with calcium arsenate-Bordeaux were further emphasized in experiments conducted on three different farms in 1935, in which increases in yield of 39, 85, and 67 per cent, respectively, were obtained. These experiments are described in more detail in the Virginia Truck Experiment Station Bulletin 92.

The value of spraying potatoes for the control of the potato flea beetle with a calcium arsenate-Bordeaux mixture (2-4-6-50) is very apparent from a study of the results obtained during the five-year period, as given in table 2. As shown in this table the average yield for the treated plats was 230 bushels of U. S. No. 1 potatoes on each acre as compared with 172 bushels from the untreated, which is an increase of 58 bushels or 34 per cent. It may also be noted that when the potato flea-beetles were less abundant in 1936 an increase in yield of 16 per cent was obtained as compared with increases of 40, 50, and 58 per cent in 1933, 1934, and 1935 respectively when the flea-beetles were more abundant. This indicates that the increases in yield are largely caused by controlling the potato flea beetle.

Since dusting is often preferred to spraying and as many of the potato growers in this section are better equipped to dust than to spray, comparisons were made of these two methods of applying calcium arsenate-copper sulphate-hydrated lime mixtures. In experiments for the four seasons, 1932 to 1935 inclusive, 24 sprayed plats gave an average yield of 219 bushels of U.S. No. 1 potatoes to the acre, whereas 24 dusted plats gave an average of 196 bushels on each acre; and 24 untreated plats gave 158 bushels to the acre. From these results it is apparent that spraying with calcium arsenate-Bordeaux gave higher yields than calcium arsenate-copper sulphate-lime dusting. However, it should be remembered that the dusted plats gave marked increases in yields over the untreated plats, and dusting can be profitably resorted to when for some reason spraying is impracticable.

In tests conducted in 1936 on three different farms the plats were replicated three times on one farm; four times on another farm; and six times on a third farm. All plats consisted of four rows 30 inches apart and varied from 320 to 423 feet in length depending on the various farms. No dusts were included in the experiments this season. Flea beetles and leafhoppers were less numerous than in 1935, whereas tarnished plant bugs were more numerous.

TABLE 2.—*A five-year comparison of yields from unsprayed plats with those from Calcium Arsenate Bordeaux (2-4-6-50) sprayed plats*

Treatment	Bushels U. S. No. 1 Potatoes to the Acre					
	1932	1933	1934	1935	1936	Average
Calcium arsenate Bordeaux	232	243	180	227	268	230
Untreated check	189	173	120	144	232	172
Increase:						
Bushels	43	70	60	83	36	58
Per cent	23	40	50	58	16	34

In 1936, weather conditions greatly curtailed the benefits that were obtained from spraying for the control of the potato flea beetle. Dry hot weather early in the season reduced the flea beetle injury by decreasing the number of beetles. Then heavy rains at the end of the season interfered with spray applications at the time the new brood of beetles was appearing. Also because of the abundance of moisture the plants grew so rapidly that they were better able to withstand the injury inflicted by the new brood of beetles that matured about the 20th of June. However, Bordeaux treated plats gave as high as 20 per cent increase in yield above the untreated plats.

Tests were conducted on two farms in 1936 to determine the best spray schedule for the control of the potato flea beetle with a calcium arsenate-Bordeaux spray (2-4-6-50). The results are given in table 3. The highest yields and the best foliage protection resulted from spraying six times at seven to ten-day intervals throughout the growing season. Late spraying seemed to be more important than early spraying, because the new brood of beetles, which appears about the 20th of June is much more abundant and injurious than the over-wintering beetles found in the field earlier in the season.

Tests were made with different strengths of Bordeaux spray on two farms in 1935 and on one farm in 1936. In these tests, untreated

check plats were compared with plats treated with calcium arsenate-Bordeaux sprays at strengths of 2-2-3-50, 2-4-6-50, and 2-6-9-50. The yields and the average number of potato flea beetle feeding scars on each leaflet for each treatment and for the untreated check are given in table 4. As shown in this table, the untreated checks gave significantly lower yields and showed more foliage injury than any of the treated plats. The differences among the yields of potatoes obtained from the plats sprayed with weak, average, and strong Bordeaux were not statistically significant. However, the weak Bordeaux did not

TABLE 3.—1936 *Results of spraying with 2-4-6-50 Calcium Arsenate-Bordeaux Mixture to determine the most effective spray schedule for potato flea beetle control*

Applications Received		Yields in Bushels of U. S. No. 1 Potatoes to the Acre	
Number	Time*	Farm No. 1	Farm No. 2
6	1st, 2d, 3d, 4th, 5th, 6th	216	320
3	2d, 4th, 5th	208	312
5	1st, 2d, 3d, 4th, 5th	206	304
4	2d, 3d, 4th, 5th	204	307
3	3d, 4th, 5th	204	311
3	1st, 3d, 4th	195	299
3	1st, 3d, 5th	188	292
0		180	280
Difference required to be significant		12.8	20.0

*1st, 2d, 3d, 4th, 5th, 6th for Farm No. 2 refer to the following dates: May 16, 27, June 8, 18, 26, and July 2 respectively; for Farm No. 1 May 10, 22; June 1, 15, 22, and 29 respectively.

TABLE 4.—*Results of testing different strengths of Bordeaux Mixture for the control of potato flea beetles in* 1935 *and* 1936

Strength of Bordeaux*	Flea Beetle Leaf Injury Average Number of Holes per Unit Area of Leaf			Yield in Bushels of U. S. No. 1 Potatoes to the Acre		
	1935	1936	Average	1935	1936	Average
2-3-50	15	8	11.5	226	256	241
4-6-50	11	4	7.5	250	261	256
6-9-50	7	4	5.5	246	253	250
Untreated check	73	41	57.0	163	217	190

*The weight in pounds of copper sulphate is given first; hydrated lime, second; and gallons of water, third. Two pounds of calcium arsenate were used in each of these mixtures.

seem to give so good foliage protection or so high a yield as the average strength Bordeaux. Likewise the strong Bordeaux gave slightly better foliage protection than did the average strength Bordeaux but did not give so high a yield. It was observed in the field that the plants sprayed with strong Bordeaux were slightly stunted and that they wilted to a greater extent during hot dry weather than did the other plants. This may account for the yield of these plats being slightly lower than the yield of those sprayed with the standard strength of Bordeaux mixture.

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TESTING SEEDLING POTATO STOCKS FOR SPECIFIC HORTICULTURAL FACTORS UNDER CONTROLLED CONDITIONS

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The objective of a potato breeding and testing program is to secure varieties of superior quality capable of producing high yields. With potatoes being grown under a wide range of conditions and subject to a host of diseases, insects, and other difficulties, this becomes a very complicated task of considerable magnitude. At the present stage of the program it seems pertinent to take stock of the adequacy of testing methods with a view to improving them.

Field variety tests have been reported for many years by horticulturists and agronomists yet there is still much uncertainty concerning the desirability of well-known strains or varieties for certain specific regions. These variety tests have been of limited value as a guide for either local or more widespread practice because of a number of reasons. Some of these are: (a) Improper field technique such as number, size and arrangement of plats or protection against competition, and planting at the wrong season, securing seed from variable sources, etc. (b) Insufficient data concerning environmental

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factors during the trial such as soil, rainfall, temperature, sunshine, etc. (c) Incomplete data, or failure to report concerning the differential response of varieties to certain seasonal conditions, maturity at harvest time, classification of tubers with regard to grade or defects, etc., and (d) Great variability in environmental conditions within a season or between seasons in any one region.

However, when all ecological information desired is provided and these sources of error have been reduced to the minimum, one is still in a quandary for we lack facts that enable us to determine why varieties perform in a certain way, and we can therefore only make a guess as to their probable suitability. As a result, most field variety tests are useful for determining gross differences but of very limited value for supplying specific information which is of fundamental importance. The reason seems quite obvious. In testing varieties under field conditions we are testing for a number of factors that are all in turn influenced by a number of variable and uncontrollable factors in the testing environment.

As a consequence of this situation it is necessary to test a group of varieties during a number of years until a variety has been exposed to most or all of the unfavorable conditions which are likely to occur in the region before its relative suitability, relative inferiority or superiority can be established. Varieties must eventually fit into these variable conditions, but is there not some more certain way of determining their characteristics? It seems quite evident that instead of testing for such complex factors as yield and quality under a complex set of conditions we should use some analytical process, which will involve a determination of how certain ecological factors influence certain characteristics in the species and in this manner determine the response of a given variety to a given set of conditions.

When an extensive body of specific information is available concerning the morphological and physiological or ecological characteristics of a variety, recommendations may be made with a fair degree of assurance if the climatic eccentricities of a region are also understood. Such specific facts can be developed in less time and with more certainty with controlled tests conducted for specific purposes in the greenhouse, laboratory or even in the field than by the general field test, which is a measure of many complex and never identical factors. Controlled tests are the only means of determining the facts concerning some important varietal characteristics.

A technique of this kind has long been successfully used by pathologists in determining the degree of susceptibility or resistance of

seedlings or varieties to various strains or species of organisms responsible for disease. It is being used to a limited extent in the present potato breeding program and its use should be expanded by testing for more diseases and by making the tests more specific, for example, by growing stocks in soil uniformly infected with a known virile organism and then controlling all environmental factors in order to bring about a maximum infection. Work of a similar nature is being conducted with regard to the insect pests of a few crops. Agronomists and foresters have recently found a controlled specific testing procedure very useful for determination of breeding lines that are resistant to drought (1, 3, 4, 11), et al., and in cold hardiness tests (8) thereby saving many years of time and much expense.

Horticultural Factors in Variety Development

Many so-called horticultural aspects are involved in the development of a variety of potatoes. In the ensuing discussion an effort will be made to enumerate some of the most important of these horticultural factors that might be the object of specific testing under controlled conditions for the purpose of determining the characteristics of a variety, strain or seedling. The time or place in the breeding program where any one of these tests should be used will be determined by the facilities, the nature of the factor involved, etc. In some cases it may be very desirable to make the tests very early, even on seedlings so as to waste no time on inferior stocks. In other cases the testing might be for the purpose of determining the facts not with the hope of finding breeding stock but to determine the limitations of a variety. No one worker should be expected to test for all of the factors involved but by the exchange of material all lines should be tested for each factor. By establishing the idiosyncracies of a stock much waste of time and effort may be avoided and extensive field trials might be greatly reduced or results from them could be understood better.

The horticultural factors that appear worthy of consideration and some suggestions concerning type of testing are as follows:

1. *Metabolic efficiency or tuberization ability.* The ability of the variety to store carbohydrates under specific types of conditions typical of those under which potatoes are grown, such as long warm days, long cool days, or short cool days should be known. It is important to know how a variety will produce tubers when conditions are very favorable for vegetative growth, as with high moisture, high temperature, or high nitrogen supply. If it produces tubers very read-

ily under conditions favorable for tuberization it is important to know whether it can then make sufficient vegetative growth to bring about the production of a tuber crop of reasonable quantity. It might be desirable to know something of the relative chlorophyll content of leaves of different breeding lines for chlorophyll content has been found to be a good index of the productive capacity of selfed lines of corn and their hybrids (13). Varieties may differ in their response to different fertilizer elements. Information concerning the respiration rate of different lines may be very useful in determining varieties most suitable for warm regions as has been the case with apples and peaches (6). It is very desirable to know the degree of versatility of a variety because of the fact that seed potatoes are moved about over very widely different regions. A variety well adapted to the south may be found impractical unless it will tuberize well in the north. The determination of these characteristics will require well equipped greenhouse space but much can be done by periodic harvesting of varieties in field tests conducted under distinctive conditions.

2. *Morphological response* to different environments, that is determination of the effect of conditions favorable to vegetative growth or to tuberization, such as long and short days with high and low temperature perhaps with high or low N or moisture supply, upon ratio of tubers to tops, length of stolons, number, size and shape of tubers, depth at which tubers are produced, probability of stolons coming to surface of soil and producing tops, etc.

3. *Susceptibility to secondary growth* such as knobs, growth cracks, excessively elongated tubers, dumb-bells, bottle necks, etc. This can be determined in the field in regions of low rainfall by withholding irrigation water until tuberization is well under way but has already been retarded. Then if an abundance of irrigation water is supplied the weakness for any or all types of secondary tuber growth should become very evident. Only a relatively small planting would be necessary and one testing would be sufficient for all except border line cases. If desired—this testing could be done in the greenhouse by growing the plants in gravel and altering the concentration of the nutrient solution according to the method described by Withrow and Biebel (14).

4. *Resistance to drought and heat* is very important at some time in almost every region. It will very probably be possible to develop a technique for determining the ability of a variety to survive or recover when subjected to a standarized test of 6 or 8 hours involving high temperature, low humidity, and wind movement with or without

high soil moisture. Such a technique is being used satisfactorily in agronomic breeding programs (1-4).

5. *Resistance to tipburn* will involve a test similar to or perhaps identical to that used for testing drought resistance. Perhaps damage from both of these sources may result from excessive water requirements that are not easily satisfied under periods of stress. If such differences exist they should be determined so that varieties with high moisture requirements need not be considered in regions of limited moisture supply or of low humidity. This testing should be done where the problem is not complicated by insects that cause similar symptoms.

6. *Frost resistance* can very easily be determined in the freezing chambers now available at many experiment stations. Perhaps we should consider not only the susceptibility of the plant top to freezing but should also determine if the tubers of different varieties vary with regard to ease of freezing or time of injury.

7. *Root habit of varieties.* The limited amount of work that has been done indicates that there are distinct differences in varieties as to type and extent of root system. As this may have an important bearing upon the ability of a plant to obtain water and survive periods of stress it may be worthy of study. It has recently been shown by Lyness and Smith (5, 12) that corn varieties differ in their capacity to absorb phosphorus and that this ability seems to be associated with the size of the root system.

8. *Tuber cracking at harvest time,* is a major cause of grade defects with the Triumph in the west and occasionally serious with other varieties in other sections. A standard method of testing for susceptibility to cracking will need to be developed and tubers for testing should be produced under a given type of conditions. Perhaps complete freedom from this defect cannot be acquired but the degree of susceptibility should be known so that susceptible varieties can be avoided in regions where the trouble may be expected.

9. *Wound healing capacity*—to be determined under standardized laboratory conditions that are most favorable for wound healing and perhaps also under conditions similar to those that might occur in production but that are recognized as being relatively unfavorable. This is of fundamental importance because of the losses occurring when seed pieces rot in the soil or when tubers are damaged at harvest time. Lines showing poor wound healing capacity should be used cautiously and should not be introduced. Some of the recent introductions do not seem to heal their wounds as well as might be desired.

10. *Storage response*—especially the degree to which tubers of a variety undergo carbohydrate changes. A variety that can be stored at low temperatures without developing a high sugar content would be very useful to the manufacturers of potato chips and French fried potatoes. It is also important to know the physiological storage life of a variety.

11. *Length of rest period.* Southern growers desire a variety that grows quickly but such a variety might be an abomination to northern growers or to dealers. The length of the rest period under a standard set of conditions should be fairly definitely defined when a new introduction is described. Varieties with very short rest periods are probably of very limited value.

12. *Cooking Quality.* The relative desirability for various culinary purposes should be determined for various varieties or stocks before too much development work is done with them. Up to the present time numerous cooking tests have been reported, but the net result in specific information is very small. Practically nothing is known with much degree of certainty regarding the effect of different environmental and nutritional factors upon cooking quality. It has been difficult to determine varietal differences. Some improvement in cooking testing technique has been reported from Germany by Rathsack (9) and similar methods are being perfected in several laboratories in the United States. However, will much progress be made until we isolate the effect of certain factors upon specific aspects of tuber composition and culinary use? Would it not be desirable to produce tubers of various varieties under controlled conditions, for example, to determine various culinary qualities of tubers grown with long-warm days in contrast with those grown with short-cool days? Might it not be possible that some varieties will cook better than others if produced under corn-belt conditions, whereas the same differences would not apply if grown under northern Maine or western dry land conditions? Tubers of different varieties selected under field conditions for cooking tests may not be of the same degree of physiological maturity and with the complexities resulting from the constantly changing environmental factors tubers of the same size but of different varieties growing in adjacent rows may have been subjected to very different conditions and therefore the variability might be the result of the environmental complex and not the variety.

It may be said that potatoes should not be grown in regions where some of these difficulties are serious, or where conditions are not ideal for growing potatoes. If carried very far this reasoning might elim-

inate most commercial regions as there are few, if any regions, that do not have some serious shortcomings that are more or less common every year and some very serious shortcoming at unpredictable intervals. For example, Maine has late blight, many western irrigation districts sometimes have water shortage or irregular delivery, unseasonably late frosts occur in the south and the Wisconsin-Minnesota district at times suffers from drought. Consequently, any variety used in any district should be reasonably immune not only to the difficulties frequently encountered in a region but also to those that occur at rare intervals.

This discussion has deliberately been limited to so-called horticultural aspects. Numerous pathological and entomological aspects are deserving of similar attention.

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SECTIONAL NOTES

Louisiana

A majority of the Louisiana potato growers in the four larger commercial potato producing parishes (counties) voted in favor of establishing potatoes as a special crop in the 1938 Soil Conservation Program. The referendum was taken only in those parishes having fifty (50) or more growers producing over 200 bushels annually. The four parishes included Lafourche, Terrebonne, Pointe Coupee and Rapides. There are about 1,000 such growers in the above parishes.

Louisiana has approximately 48,000 potato growers, but the majority of them are small growers who would not be affected by the proposed program.

It is problematical regarding the reaction of a marketing agreement. This type of program has not been officially discussed with growers. It has been realized, however, that some organized effort in distribution should be beneficial, because of the necessary rapid movement of the early crop within a short period, and the overlapping of peak movements in competing early potato sections in some seasons caused by the varying weather conditions, and the uncertain harvesting conditions.

Louisiana growers produced 10,000 hundredweights of Louisiana certified Triumph seed this spring. Shipments of this variety are now moving to Cuba.

Comparatively little northern certified seed for next spring's crop has been contracted for to date. Growers are waiting for lower prices. The Louisiana growers are primarily interested in the Northern state certified seed of Triumph and Katahdin varieties. The seed law in Louisiana requires all seed potatoes, other than state certified seed, to be labelled "non-certified." (Oct. 11).—J. G. Richard.

Maine

The rejection of the proposed Marketing Agreement and Order for potatoes in Maine has been disappointing. The vote was closer, however, than was expected—the final figures being 516 in favor of and 660 against the Marketing Agreement. The rejection of the Marketing Agreement resulted from appeals to political prejudice, spreading of misinformation during the very short time available to consider the real merits of the proposal. Given a longer time to get the facts over to growers, and adequately answer critics, the results

would have been much different. There are definite indications that producers are at the present time, regretting their decision and undoubtedly there will be a much further definite trend of thinking in that same direction as the season progresses. In the end this probably will all work out for the best.

At the same time that the Marketing Agreement was rejected, the program of Potato Goals was enthusiastically endorsed by a vote of 1447 to 109.

In spite of the set back on the Marketing Agreement, growers in Maine have been assuming more and more leadership in solving their own problems. This was evidenced by the enactment of the State Branding Law two years ago and the Industry Tax Program, for advertising purposes, last winter. In many other ways there has been tangible evidence of the feeling that the problems of marketing are of equal importance with those of production. We hope that growers in other areas will be charitable toward our failure on the Marketing Agreement.

Potatoes have practically all been harvested and either shipped or placed in storage. The total shipments approach those of last year's figures with the quality continuing very good and with marked consumer interest in Maine potatoes. The digging season has been particularly favorable, the crops being placed in storage in splendid condition. The quality of the crop, its distribution, both taken in conjunction with the Potato Advertising Program made possible by the one cent per barrel Industry Tax, will place Maine potatoes favorably before a consuming public scattered over a great geographical area.

One feature of the Advertising program which has aroused much interest in Maine, and considerable interest elsewhere, has been the International Picking Contest. It was the pleasure of the writer to assist in making this possible. A crowd of from four to five thousand witnessed the fifteen minute contest in which the winner picked eighty-six pecks of potatoes. The feature was broadcast over an Eastern hook-up and photographed by a leading news service. It has probably helped more to show growers here, in a tangible way, the value of the State Advertising Campaign than any thing else that has happened.

A considerable volume of seed is being shipped to the Argentine again this year. This time shipments are being made in crates holding 111 pounds of potatoes consisting chiefly of the Green Mountain and Katahdin varieties.

Interest is more wide spread, than ever before, in shipping consumer size packages. New containers, like boxes and cartons, are being aggressively pushed by energetic commercial organizations all of which, of course, reflects the widely growing tendency to merchandise more attractively and effectively to arouse consumer interest.

A constructive move for the industry made possible by money received from the Industry Tax is a consumer study which will be started shortly. From a long range point of view this study of consumer preferences in potatoes may be the most important contribution of all by the advertising fund. (Oct. 14).—FRANK W. HUSSEY.

MASSACHUSETTS

Harvesting of the Green Mountain crop is now in full progress. The yields are running slightly below last year with reasonably good quality, except some rot,—especially from unsprayed fields. Prices continue low with all the cobbler crop disposed of.

A small percentage of growers voting on the matter of control, showed a majority in favor of its inclusion in the 1938 Agricultural Conservation Program. (Oct. 13).—RALPH W. DONALDSON.

MINNESOTA

Minnesota potato growers, in general, have had the satisfaction of producing a good crop of potatoes this season, but prices paid to date have been far from satisfactory.

Fifteen to eighteen cents a bushel is scarcely a sufficient return to create a great deal of enthusiasm among the potato growing fraternity. Reports that certified seed stock has been sold for considerably more money have also reached this office; I hope these reports are true.

The vote in favor of the potato agreement is an indication that growers are willing to cooperate in placing a better quality product on the market, although the U. S. No. 2 grade, which is the minimum grade to be marketed under this agreement, may not be a particularly desirable one. However, the agreement should encourage the growers, and it might possibly aid materially in keeping inferior stock from the market and bring better prices.

At present Minnesota has a compulsory potato inspection law which may result in the shippers grading more closing and should have a healthy reaction on prices. This law went into effect on the 15th

of September. At present, about forty inspectors are stationed at the important potato shipping centers.

The acreage inspected for certification this year was approximately 240 more than in 1936, and the final acreage passed for certification was nearly the same. Of 533 acres of the White Rose variety inspected, 40 per cent were badly damaged by heavy rains early in the summer. The extent of this damage is now being determined. This water damage was confined to one particular area in the extreme northern part of the state and affected grain as well as potatoes.

Yield reports are now being obtained from the certified seed potato growers, and we should have a fairly accurate estimate of the amount of certified seed stock available by the end of this month. A summary of the certification work for 1937 is given in the following table:

Variety	Total Acreage Inspected	Acreage Rejected or Withdrawn	Acreage Passed
Bliss Triumph	2580.30	91.50	2488.80
Irish Cobbler	4810.35	611.16	4199.19
Early Ohio	450.71	147.0	303.71
Warba	495.97	64.08	431.89
White Gold	45.0	3.0	42.0
Chippewa	131.36	8.6	122.76
Green Mountain	68.93	2.0	66.93
White Rose	533.20	234.95	298.25
Rural New Yorker	8.6		8.6
Katahdin	24.45	6.75	17.7
Spaulding Rose	12.0		12.0
Russet Rural	2.2		2.2
Golden	3.1		3.1
Red Warba	1.2		1.2
Burbank	1.0	.5	.5
	9168.37	1169.54	7998.83

(Oct. 4).—A. G. Tolaas.

Nebraska

Nebraska growers have nearly completed the harvesting of their potato crop. Owing to an epidemic of early blight, in addition to

a killing frost on the 24th and 25th of September, which stopped the growth of all potato fields, the growers were able to begin harvesting somewhat earlier than usual and a greater portion of their crop has been harvested than in most years. Practically all of the harvesting will be completed within a week.

The yields are somewhat disappointing on the dry land. Those areas, which experienced severe drought, are reporting yields varying from 15 to 50 bushels to the acre. The major portion of the crop is being harvested, despite the low prices that are being paid at the present time.

This is in striking contrast to the season of 1936 when practically one-half of the dry land acreage was abandoned. About one-half the dry land acreage will have yields from 50 to 100 bushels to the acre. The quality is reported good but scab is reported from a number of sections. Somewhat erratic growing conditions have been responsible for off-type potatoes, thereby reducing the quality.

The effect of the early blight on the irrigated crop was less than was anticipated. Undoubtedly there has been some reduction in yields, nevertheless the yields reported range from 200 to 500 bushels to each acre. The quality, as a whole, is exceptionally good. The main trouble is the lack of proper handling methods at the time of harvest, which is reducing the quality materially in the irrigated sections, because of heavy mechanical injury to the potatoes.

A consistent effort was made this season by the State Extension Service of the College of Agriculture, in cooperation with local county agricultural agents, and other interested parties, to eliminate the excessive mechanical injury caused by improper harvesting and handling methods. The State Potato Specialist has made a special project of this campaign. Radio programs consisting of short talks were broadcast to encourage growers to handle their potatoes carefully. As a result of this campaign it is felt that the quality of table stock to be shipped from this territory will be improved.

The prices paid to growers, who shipped prior to this week, ranged from fifty to sixty cents per hundred F. O. B. This week shipments have fallen off because of the beginning of the sugar beet harvest. Partly on account of the slackening of shipments and also because of an improved condition in the markets, prices to growers have advanced five to ten cents per hundred.

The growers in this section, which is included with Wyoming and Colorado, as a marketing group, in the National Marketing Control Program, voted in favor of control for this crop. The members of

the control committee are now in Chicago setting up the machinery with which to administer the act. It is hoped that such machinery will be brought into motion within a short time as the potato deal in this territory is in operation. (Oct. 8).—MARX KOEHNKE.

NEW YORK

During the month of September potato digging demonstrations were held in Onondaga, Erie, Cortland, Wyoming, Alleghany, and Steuben counties. The majority of these demonstrations were well attended since the growers are interested not only in how to reduce tuber injury by proper operation and equipment of the digger, but also in methods which will increase the efficiency of the digger. In nearly every case, it was easy to demonstrate how bruising can be reduced by attention to such factors as setting the point deeper, slowing the speed of the chains, reducing agitation, changing from an extension elevator to a continuous apron, use of an outside rear drive chain, tightening of the digger chain to remove the whip, and rubber padding of the vine tines and bar on the shaker-bar type of digger.

Very little digging has been done in western New York on account of the slow market and because of the fact that many fields are still green. The crop in Northern New York is excellent and harvesting is nearly complete. The yields reported in the vicinity of Rochester and Syracuse are poor on account of dry weather. Growers show a decided tendency to store the crop with the expectation that prices will improve.

The vote on the potato acreage reduction plan, as part of the Agricultural Conservation Program, was surprisingly low. According to the census of 1935, 131,075 farms reported potatoes in New York in 1934. This is 74 per cent of all farms. Of these, only 2334 growers, or less than two per cent voted. For the few who voted sixty per cent voted affirmatively and forty per cent negatively. This can hardly be said to truly represent the sentiment of the potato grower in New York State.

An effort will be made this fall to market graded and branded potatoes cooperatively in Erie County. The G. L. F. Exchange, Inc., has established a central grading plant at Orchard Park where growers who wish to market this way may do so by delivering their crop and paying a nominal charge on the basis of fifteen and sixty-pound paper sacks for the grading, packing and marketing service. This plan is very similar to the one in operation in Pennsylvania last year. (Oct. 11).—E. V. HARDENBURG.

North Carolina

All votes on the proposed marketing agreements have not been returned, but to date the growers are in favor of the agreement by the ratio of approximately seventy to one.

Our certified seed acreage this year is very small, probably not exceeding fifteen acres. The crop in the mountainous section of the state has been good this year. Nearly all this crop, however, is bought by trucks at the farms and transported to the nearby Piedmont markets of North Carolina and Tennessee. (Oct. 7).—Robert Schmidt.

Ohio

Fifty-one counties in Ohio were requested to ballot on the potato goal referendum. Reports have arrived from 49 of the 51 counties. Four-hundred and four votes were cast; 257 voted affirmatively, and 147 negatively. Since the vote was so small in all the counties, it is doubtful if the three remaining counties will materially change the final results.

Seven acres of potatoes were entered and passed, for certification Approximately 1400 bushels will be produced.

Late potatoes are now being harvested. The majority of the yields are disappointing, especially the late-planted yields where the tubers are small. (Oct. 9).—Earl B. Tussing.

Pennsylvania

Much interest is being shown in the potato report for the 1st of October. Much of the western part of the state experienced a heavy frost early in September which cut down fields which might otherwise have produced good yields. Planting was delayed in some of these sections until June on account of the wet weather, consequently, the tuber size is small. Some fields will not be harvested. Blight has also taken severe toll in unsprayed fields. The acreage next year will doubtless be materially reduced outside the eastern section where the crop is excellent this year. All except the real potato growers who reside on farms with good fertility, are discouraged with the yields and prices.

The Potato Growers Association is engaged in an active marketing campaign. Better grading and better sales to stores in bushel and peck paper bags are being pushed. (Oct. 14).—J. B. R. Dickey.

We are anticipating a good crop of certified seed in Pennsylvania this year. Although growing conditions for early potatoes were quite dry, an excellent crop of smooth potatoes of good size is reported. The late crop, or Rural type potatoes were grown under more favorable conditions of moisture, although they are not yielding so well as many growers anticipated. Tubers, however, are generally smooth and of an economical seed size.

If our crop yields average the same as last year, we anticipate a total production exceeding 200,000 bushels of certified seed.

The varieties certified to date, compared with 1936, are divided as follows:

	1936	1937
Russets	426.75	385.25
White Rurals	115.10	105.75
Cobblers	150.75	29.00
Bliss Triumph	37.50	....
Katahdin	9.90	29.00
Nittanys	....	247.00
	740.00	796.00

Although this acreage is slightly higher than it was last year, we expect a few more rejections by the time the crop is harvested and the yields tabulated. (Oct. 14).—K. W. Lauer.

Wisconsin

As stated in previous reports from this office, conditions throughout Wisconsin vary so widely that it is difficult to give an accurate report. Yields, in general, have been greatly reduced. In many sections the crop was badly damaged during the latter part of August and in a large number of these there has not been any very decided improvement or recovery. Many areas are reporting yields from fifty to seventy per cent normal. We have local areas which have reported crop failures.

There are, of course, some compensating favorable reports also, in that several sections of the state show improved type and quality.

Wisconsin should have about 250 cars of certified seed eligible for certification this year. A limited amount of this crop has been placed on the table stock market.

Some very satisfactory yields have been obtained from the

area under irrigation. Probably from one thousand to twelve hundred acres of potatoes were watered in Wisconsin this year.

The Wisconsin Potato Growers' Association has practically completed arrangements for five special potato institutes combining potato exhibits and convention features. Additional displays connected with all important production lines are being assembled for these special one-day events. This plan is being substituted this year for the central Potato Show of one week's duration as held in the past. The annual convention of the Wisconsin Potato Growers' Association will be held at Rice Lake in December at the close of the above series of local potato events. (Oct. 11).—J. G. MILWARD.

ANNUAL MEETING

The 24th Annual Meeting of the Potato Association of America will be held at Indianapolis from Tuesday, December 28 to Thursday, December 30. Joint sessions have been arranged for Tuesday afternoon with the American Society for Horticultural Science and on Thursday morning with the American Phytopathological Society.

Titles of papers to be presented at this meeting should be sent to the Secretary on or before November 10. All papers will be printed in the American Potato Journal.

ERRATA

In the article by Mabel C. Rogers, Charles F. Rogers and Alice M. Child, in the September issue, line 5, page 271, first paragraph under *Chip Making Studies* should read: "the amount of fat used in proportion to cook the potatoes within 3 to —."

On page 288, line 2 "which" should be used after potato, so that it reads: "A condition within the potato which permits an increase."

American Potato Journal

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THE TWENTY-FOURTH ANNUAL MEETING

The Claypool hotel has been designated as the headquarters for the Potato Association of America at the Indianapolis meetings. This will also be the headquarters for the American Association, Sections F, G and O and the American Society for Horticultural Science. It was impossible to arrange for a meeting room in the Claypool hotel but the sessions will be held in Rooms 1625-26 in the Washington hotel, only one block distant.

A joint session has been arranged with the American Society for Horticultural Science and Section O on Tuesday afternoon the 28th of December. This session will be devoted to the presentation of papers on the rôle of minor elements in economic plant production. A joint session has also been arranged with the American Phytopathological Society for Thursday morning the 30th of December.

At the regular sessions of the Association the committees on potato consumption and dietetic value, standardization of cooking tests, standardization of field plot technique, nomenclature, certification, virus diseases, and the various research committees will report on the work of the year. The titles of papers have been submitted by Fitch, Metzger, Smith, Hardenburg, Reddick, Lea, Orton, Krantz, Anderson, MacLeod, Ware, Child and others. The program has been sent to the secretary of the American Association but if additional titles are sent to your secretary prior to the 10th of December they will be included in the Association program to be printed in the December issue of the Journal.